Claims

1) An optical device comprising

- an anode
- a cathode comprising barium, strontium or calcium; and
- a layer of organic semiconducting material between the anode and the cathode

wherein a layer of hole transporting and electron blocking material is located between the anode and the layer of organic semiconducting material.

2) An optical device according to claim 1 that is an electroluminescent device.

3) An optical device according to claim 2 that is a full colour device wherein the layer of organic semiconducting material comprises red, green and blue electroluminescent materials.

4) An optical device according to any preceding claim wherein the cathode comprises barium.

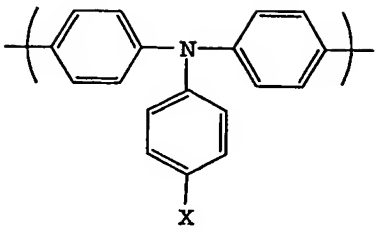
5) An optical device according to any preceding claim wherein the layer of hole transporting and electron blocking material comprises a triarylamine.

6) An optical device according to claim 5 wherein the triarylamine is provided as repeat units of a polymer.

7) An optical device according to claim 6 wherein the polymer is a copolymer comprising one or more arylene co-repeat units.

8) An optical device according to claim 7 wherein one or more of the arylene co-repeat units are selected from optionally substituted fluorene, spirofluorene, indenofluorene and phenylene, preferably 9,9-disubstituted fluorene-2,7-diyl.

9) An optical device according to any one of claims 6-8 wherein the the triarylamine repeat unit is selected from repeat units of formulae 1-6:



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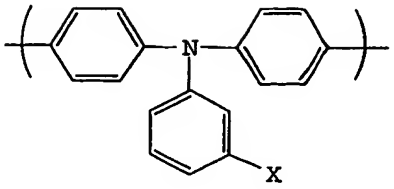

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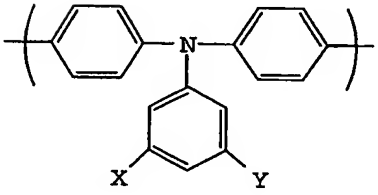

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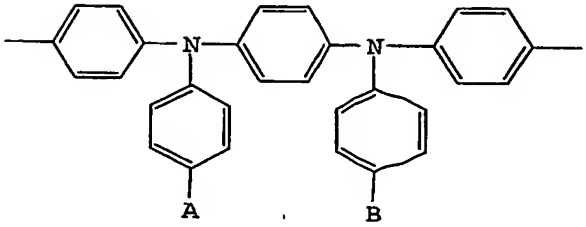

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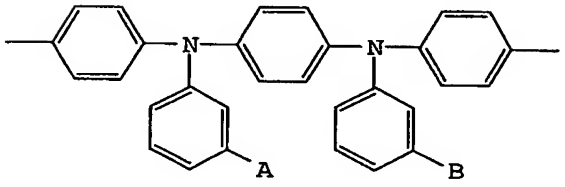

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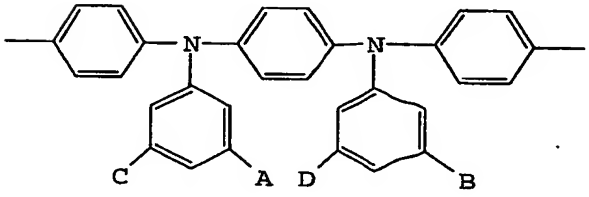


6

wherein X, Y, A, B, C and D are independently selected from H or a substituent group. More preferably, one or more of X, Y, A, B, C and D is independently selected from the group consisting of optionally substituted, branched or linear alkyl, aryl, perfluoroalkyl, thioalkyl, cyano, alkoxy, heteroaryl, alkylaryl and arylalkyl groups.

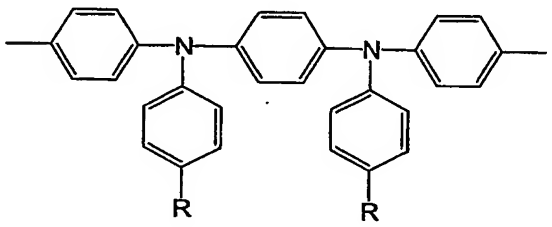
10) An optical device according to any preceding claim wherein the layer of organic semiconducting material is a semiconducting polymer, preferably a semiconducting copolymer.

11) An optical device comprising a semiconducting copolymer according to claim 10 wherein the semiconducting copolymer comprises repeat units selected from

optionally substituted fluorene, spirofluorene, indenofluorene and phenylene, preferably 9,9-disubstituted fluorene-2,7-diyl.

12) An optical device comprising a semiconducting copolymer according to claim 10 or 11 wherein said semiconducting copolymer comprises a repeat unit selected from triarylamine repeat units of formulae 1-6 defined in claim 9.

13) An optical device according to claim 12 wherein said co-repeat unit is a repeat unit of formula (I):



(I)

wherein each R is independently selected from the group consisting of H or optionally substituted, branched or linear alkyl, aryl, perfluoroalkyl, thioalkyl, cyano, alkoxy, heteroaryl, alkylaryl and arylalkyl group, more preferably C_{1-10} alkyl, yet more preferably butyl.

14) An optical device according to any one of claims 12-14 wherein the molar ratio of the triarylamine repeat units is less than or equal to 50 %, more preferably less than or equal to 30 %, most preferably 1-10 %.

15) An optical device according to any preceding claim wherein a layer of hole injecting material is located between the anode and the layer of hole transporting and electron blocking material.

16) An optical device according to claim 15 wherein the layer of hole injecting material is poly(ethylene dioxythiophene).

17) An optical device according to any preceding claim wherein the cathode comprises elemental barium.

18) A method of forming an optical device comprising

- providing a substrate comprising an anode;
- depositing a layer of hole transporting and electron blocking material onto the anode;
- depositing a layer of organic semiconducting material over the layer of hole transporting and electron blocking material; and
- depositing a cathode comprising barium, strontium or calcium over the layer of organic semiconducting material.

19) A method according to claim 18 wherein a layer of hole injecting material is deposited between the anode and the layer of hole transporting and electron blocking material.

20) A method according to claim 18 or 19 wherein the layer of hole transporting and electron blocking material and the layer of organic semiconducting material are both deposited from solution.

21) A method according to claim 20 wherein both the layer of hole transporting and electron blocking material and the layer of organic semiconducting material are polymers.

22) A method according to claim 20 or 21 wherein the hole transporting and electron blocking layer is subjected to heat treatment prior to deposition of the organic semiconducting material.

23) A method according to claim 22 wherein the heat treatment is below the glass transition temperature of the hole transporting and electron blocking material.

24) A method according to any one of claims 20-23 wherein the organic semiconducting material is substantially free of cross-linkable vinyl or ethynyl groups